



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

No. XIV.

Analysis of the Blue Iron Earth of New Jersey. By Thomas Cooper, M. D.—Read May 3, 1816.

THIS earth is found in many places of New Jersey, not usually of a blue colour when dug up, but acquiring that colour after being exposed to the air. I do not enter into any geological details, because I have reason to believe this part of the subject will occupy the attention of a member of this society, better qualified, from local knowledge, to treat it than I am. I offer to the Society the following experiments, because I think the nature of the substance has been mistaken.

External Characters.

1st. It has a moderately deep smalt-blue colour, neither verging toward copper-red, like indigo and Prussian blue ; nor toward green, like mountain blue, and blue flour.

2d. Its appearance to the eye is earthy.

3d. When breathed upon, it gives out a slight earthy odour.

4th. It is moderately hard: when scratched by the point or edge of a common penknife, the streak is bluish and dusty, from the knife penetrating the substance of the stone ; but when scratched by the back of the knife, or by the nail, the streak is greyish-white and shining.

5th. It breaks with a fracture somewhat conchoidal.

6th. It adheres to the tongue with some force.

7th. When a drop of oil is poured on it, the colour becomes black, or of a deep blue, approaching to black: so that it promises to be useful as a pigment.

8th. Its specific gravity is 2,5338.

9th. It absorbs 35 per cent. of water on immersion in that fluid.

Its Habitudes when exposed to Heat.

10th. Before the blow-pipe, whether supported by charcoal, or on the bottom of a crucible, it becomes of a brown colour, and then melts into a shining greyish globule, not attractable by the magnet, unless this treatment with charcoal be continued.

11th. When this stone in powder is distilled at a low red heat for an hour in close vessels, with a pneumatic apparatus, no gas is collected, except the common air expelled by rarefaction from the containing vessel; moisture arises, which by means of a cold atmosphere, is condensed into pure water, exhibiting no chemical qualities on dropping a drop of it into muriate of baryta, or diluted tincture of galls. The powder thus distilled, loses from 23 to 24 per cent. when the distillation has been urged.

12th. On calcining 100 grains in a full red heat for an hour, 80 to 81 grains of a bright brown powder are procured, consisting (as will be seen) partly of the brown-red oxyde of iron, and partly of alumina.

13th. This calcined brown powder, when treated in a crucible with charcoal, or when made into a paste with wax, and burnt three several times, yielded 48 grains of iron, by means of a magnet; and there were left behind, six and a half grains of a powder not acted upon by the magnet. This last, being dissolved in sulphuric acid, diluted, and precipitated by carbonate of ammonia, possessed the common characters of alumina.

14th. When fused in small proportion with potash, for the purpose of discovering the presence of manganese, the trace of green colour was too slight to indicate any appreciable quantity of that substance.

Its Habitudes with Solvents.

15th. This stone does not dissolve perceptibly in pure rain water at the common temperature of the atmosphere; nor does the water in which it has been infused, exhibit any colour when tested by galls, or triple prussiate of potass: nor does it afford any precipitate by carbonat of potass.

16th. The sulphuric, the nitric, and the muriatic acids, dropt on this stone, excite no effervescence, they are diffused on it, and sink into it.

17th. It is not easily dissolved in *sulphuric* acid, without the aid of moderate heat. I used the top of the common ten-plate stove, of about 150° of Fahrenheit; but with heat, and after some hours digestion, it becomes a white mass with this acid; which mass is soluble entirely in boiling water, producing a clear solution; there is no effervescence during the solution.

18th. Having dissolved 50 grains of the stone in sulphuric acid, and diluted the solution with hot water, I added a filtered solution of triple prussiat of potass, made in the common way, by digesting carbonat of potass on Prussian blue, till the latter no longer became discoloured. On continuing to add this while any precipitate appeared, I obtained a quantity of the most intense and beautiful Prussian blue, which, when calcined in a full red heat for an hour, yielded forty grains of red oxyd. The remaining liquor, after filtration, and precipitation by carbonat of ammonia, afforded a precipitate which, when carefully filtered, and moderately dried, weighed about 4 1-2 grains: it was alumina. It weighed less in proportion than the alumina of experiment 13, in consequence of not being so much dried. The quantity thus obtained, of iron and alumina,

is probably not quite accurate, owing to the iron contained in the triple prussiat: but very near the truth.

19th. This stone when powdered, dissolves in *nitric acid* in the warm atmosphere of a summer's day, after 10 or 12 hours digestion, without residuum.

20th. This nitric solution, was evaporated to perfect dryness; the powdered residuum was digested in fresh nitric acid, which was again evaporated to dryness. A third portion of the same acid was now poured on the brown-red powder, and digested on it: about 1-10th was dissolved, as appeared on drying and weighing the residuum. The solution moderately diluted and filtered, exhibited but very slight shades of colour with tincture of galls and solution of triple prussiat of potass, so that but a trace of iron was taken up, as was originally presumed and intended. The digestion in nitric acid, and driving it off by heat, being meant for the purpose of oxyding the iron beyond the point of solubility in that acid. The last portion of nitric acid therefore, took up nothing but the earths. These being precipitated by carbonat of ammonia, afforded about nine per cent. of earth, when dried at the heat of 150 Fahrenheit, and consisted entirely of alumina.

21st. *Muriatic acid* dissolves this stone by heat. The solution is of a brownish-yellow colour. It leaves no residuum.

22d. *Oxalic acid* and oxalat of ammonia, occasion no precipitate from any of these solutions: hence there is no trace of any of the alkaline earths.

Experiments to discover the Presence of Puissic Acid in this Stone.

23d. Carbonat of potass digested on the powdered stone, takes away the colour, but does not dissolve the substance. The solution of carbonat of potass so digested on the stone in fine powder, being filtered, produced no blue precipitate when poured into a solution of sulphat of iron.

24th. A piece of this stone suspended for many hours in a solution of sulphat of iron, diffused no trace of blue colour,

either when immersed dry, or moistened with an alkaline solution.

25th. The following experiment was suggested and made for me by Mr. Cloud, who appears to have investigated the properties of palladium more fully than any other chemist. The nitro-muriat of palladium, and the nitro-muriat of gold, are not precipitated by the chromat of potass, but they are precipitated by the prussiats. When the red oxyd of mercury is triturated with Prussian blue, and boiled with water for half an hour, a prussiat of mercury is formed, which occasions a fawn-coloured precipitate, when added even in a very minute portion to the nitro-muriat of palladium: this precipitate is a prussiat of palladium. Red oxyd of mercury was mixed with the blue earth in fine powder, and water being added to the mixture, was boiled in a sand-bath for more than half an hour, and constantly stirred during the time: when cool, the liquor was filtered and dropped into a nitro-muriatic solution of palladium, but no precipitate appeared.

Experiments to ascertain the Presence of Phosphoric Acid.

PRELIMINARY OBSERVATIONS.

When the native green phosphat of lead, is melted before the flame of the blow-pipe on charcoal, it chrySTALLIZES on cooling into a polyhedral garnet-like kind of chrySTALLIZED mass; so does the artificial phosphat of lead, made by adding phosphat of soda to nitrat or acetat of lead; in which case the phosphat of lead precipitates in a dense white powder, speedily and distinctly. These remarks have been made by Klapproth, in his Analysis of the Phosphated Lead Ores.

When nitrat of lead, or acetat of lead, are added to any solution containing phosphoric acid, the solution of lead is instantly decomposed, and a phosphat of lead is formed. Thus, when phosphat of iron made either directly by solution in phosphoric acid, or by precipitation by phosphate of soda, is dissolved even in small quantity in the nitric acid, this solu-

tion is immediately precipitated by any solution of lead: these facts were previously ascertained.

Moreover, solutions of iron in phosphoric acid, were made both directly and by double decomposition, as by precipitating a solution of sulphat of iron by phosphat of soda. The phosphat of iron in both cases, when dried moderately, assumes a slight bluish tinge by exposure to the atmosphere; which may have led to the supposition of this blue stone being phosphat of iron. These previous experiments were made to ascertain the colour of artificial phosphat of iron.

With these facts in view, a solution of the blue iron earth (or stone) was made in pure nitric acid, freed from muriatic acid by nitrat of silver, and from sulphuric acid by nitrat of baryta: precautions which were afterwards found unnecessary for this particular purpose, the common nitric acid of commerce answering sufficiently well. This nitrated solution of the substance under analysis, was mixed gradually with nitrat of lead, and subsequently in a distinct experiment with acetat of lead. In neither case, was there any precipitate produced, as might have been expected to take place, had even a trace of phosphoric acid, combined or uncombined, existed in this nitric solution.

Again, a considerable quantity of the substance in powder, dried, but not discoloured, was rubbed up with about 1-10th of its weight of lamp-black: in another experiment with 1-10th of sulphur; in a third experiment with 1-10th of a mixture of lamp-black and sulphur. The mixed powder was put into bottle-shaped crucibles, having clay stoppers, with a glass tube of about 1-16th of an inch diameter, passing through the stopper. The clay was burned to fit the aperture, and during the experiments the stoppers were also well luted and attended to.—The mixtures were exposed to a gradual heat for half an hour, to dissipate the hygrometrical moisture, if any should remain. The stoppers constantly examined: the heat was gradually increased to a full red, at the close of an hour: during this time a lighted paper was very frequently applied to the orifice of the glass tubes whence the

vapours from the blue earth issued, but there was no trace of any thing inflammable to be discovered. Nor was any, the slightest phosphorescence discovered, on dropping the powdered stone on red hot charcoal. Hence I conclude,

1st. That the hard blue earth of New Jersey is probably the same substance with the blue earth of Jamison and Werner, the fer azurè of Haüy, and the fer phosphatè of Brochant and Brogniart; but it seems to differ somewhat from the smalt-blue fossil of the Vorau, analysed by Klaproth.

2d. That this blue earth of New Jersey, contains neither prussic or phosphoric acid.

3d. That it consists of sub-oxyd of iron, intimately united with about 1-10th of the earth of alum, and 24 per cent. of water, probably in chemical union.

4th. That it contains no perceptible quantity of silica, lime, magnesia, or the other earths.

5th. That its colour may be of vegetable origin, but I cannot venture any probable surmise concerning it.

The chrystallized earth of New Jersey, consisting of olive green chrystals, upon a bluish green earthy stone, is very similar in its geological and chemical characters, to the blue earth just described; but as I propose a more perfect analysis of these chrystals than I have yet made, I shall say no more about them at present.

THOMAS COOPER.